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Two new *Lebistina* Motschulsky, 1864 species from Kenya and Tanzania (Coleoptera, Carabidae, Lebiini)

Thorsten Assmann[1], Estève Boutaud[1], Claudia Drees[2], Tamar Marcus[1], Dorothea Nolte[1], Werner Starke[3], Heinrich Terlutter[4], Eva Völler[1], Pascale Zumstein[1]

1 *Institute of Ecology, Leuphana University Lüneburg, Scharnhorststr. 1, D-21335 Lüneburg, Germany* **2** *Zoological Institute, Biocentre Grindel, Hamburg University, D-20146 Hamburg, Germany* **3** *Sassenberger Straße 21, 48231 Warendorf, Germany* **4** *LWL-Museum für Naturkunde, Westfälisches Landesmuseum mit Planetarium, Sentruper Str. 285, D-48161 Münster (Westf.), Germany*

Corresponding author: *Thorsten Assmann* (assmann@uni.leuphana.de)

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Abstract

Two new species of the genus *Lebistina* Motschulsky, 1864 are described: *Lebistina rehagei* Assmann, Starke & Terlutter, **sp. n.**, type locality: Kenya: north of Ngomeni. Members of this macropterous species are distinguished from all other known species of the genus by their elytral coloration pattern, large body length, shape of the median lobe of the aedeagus, and shape of the mentum with one tooth showing two small tips. *Lebistina petersae* Assmann, Drees & Zumstein, **sp. n.**, type locality: Kenya, Tsavo East National Park. Members of this macropterous species differ from all other *Lebistina* species by their elytral coloration, short body length, shape of the median lobe of the aedeagus, and shape of the mentum with its sinuosity and two blunt teeth. We provide photographs and discuss the characters, including the shape of the mentum which deviates from the classical delineation of the genus *Lebistina*.

Keywords

Lebistina, *Matabele*, new species, ectoparasites, Kenya, Tanzania

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Introduction

The tribe Lebiini is one of the most species-rich higher taxa of Carabidae (Lorenz 2005), though many aspects of taxonomy and biology of many of its members are poorly known. The genus *Lebistina* Motschulsky, 1864, known exclusively from Africa south of the Sahara, seems to be an exception. The members of the genus *Lebistina* are large and are ectoparasites (Lindroth 1971) of alticine leaf beetles which are used by the Kalahari-San as an efficient arrow poison for hunting (Mebs et al. 1982, Neuwinger 2004). Furthermore, *Lebistina* larvae have been reported as a source for arrow poison for the Kalahari-San (Koch 1958, Neuwinger 2004), though this has been brought into question by Chaboo et al. (2016). The tri-trophic interaction between the toxic plant food sources of the Alticinae, the leaf beetles and their predators have been discussed numerous times in both primary and secondary literature (Jolivet 1968, Weber et al. 2008). Moreover, much information on both the hosts and their ectoparasites is available on the internet (Anichtchenko 2016, Dasgupta 2016). – Several authors discuss a case of mimicry for the imagines of both leaf and ground beetles as at least some of them show a remarkable similarity (e.g. Lindroth 1971). Therefore the genus *Lebistina* should be classified as a well-known genus of African ground beetles. The taxonomy seems to be stable, as the last nomenclatorial changes and the last description of new species date back to the first half of the 20th century (Lorenz 2005).

It was therefore surprising that we identified – after the study of the descriptions, the type material from Chaudoir's collection in Paris and the excellent collection of Basilewsky in Tervuren – two undescribed *Lebistina* species in the material collected by several coleopterologists, namely Karl Werner and Miroslav Snížek. As members of the genus *Lebistina* are an object of interest in ethno-biological, biochemical and ecological studies, we describe the given species in an attempt to stimulate research on the host-predator-relationship with its possible mimicry and toxicological properties.

Material and methods

The material examined is housed in the collections listed below:

cAsL	Collection Th. Assmann, Lüneburg, Germany (working collection, part of the Zoologische Staatssammlung München, ZSM)
cBeO	Collection M. Bednařík, Olomouc, Czech Republic
cKmL	Collection R. Kmeco, Litovel, Czech Republic
cScH	Collection P. Schüle, Herrenberg, Germany
cStW	Collection W. Starke, Warendorf, Germany
cWrB	Collection D.W. Wrase, Berlin, Germany (working collection, part of the Zoologische Staatssammlung München, ZSM)
cFaP	Collection Sergio Faccini, Piacenza, Italy
cLMM	Collection Westfälisches Landesmuseum Münster, Germany

Total body length (BL) is measured from the tip of the mandibles to the apex of the right elytron as the maximum linear distance; the width of the head (HW) as the maximum linear distance across the head, including the compound eyes; the length of the pronotum (PL) from the anterior to the posterior margin along the midline; the length of the elytra (EL) from the basal margin to the apex of the right elytron as the maximum linear distance; the width of the pronotum (PW) and elytra (EW) at their broadest point. These measurements, made at magnifications of between 8× and 50×, and using an ocular micrometer in a Leica MZ 16 stereomicroscope, were combined as ratios and/or added as follows:

PW/PL width/length of pronotum;
PW/HW width of pronotum/width of head;
EL/EW length/width of elytra.

Microsculpture was examined at a magnification of 50×.

Dissections were made using standard techniques; genitalia were preserved in Lompe solution on acetate labels (Lompe 1989), and pinned beneath the specimens from which they had been removed. The habitus photographs were taken with an Olympus E-330 digital camera in combination with a Leitz MZ 95 stereomicroscope. To achieve sufficient depth of focus, up to 40 planes were captured, and the out-of-focus planes were masked using a stacking program (Combine ZP). Post-processing was done using the software IrfanView 4.41.

Taxonomic part

***Lebistina rehagei* Assmann, Starke & Terlutter, sp. n.**
http://zoobank.org/210E8BF4-A4E2-44B2-8B97-B2C53493E2FC
Figs 1–5

Type material. Holotype male: "E-Kenya 21.4.07 / Ngomeni, N of / Nguni, leg. Snížek" (ZSM). Paratypes (5 males and 19 females): "Kenya 3./4.XI.1996 / Sagala reg., Voi / leg. Werner & Lizler" (1 individual, cAsL), "Kenya 2.XII.1996 / near Kipwezi / leg. Werner & Lizler" (1 individual, cAsL), "Kenya, 28./30.XI.1997 / near Voi / leg. Werner & Lizler leg." (1 individual, cAsL), same data as previous one, but "29./30.1997" (1 individual, cAsL), "E-Kenya 21.4.07 / Ngomeni, N of / Nguni, leg. Snížek" (11 individuals, cAsL, cFaP), "Kenya Eastern / Nguni / N of Ngomeni / 27.4.2008 / lgt. Snížek" (1 individual, cAsL), "Kenya SE / 8.-12.12.2009 / SW of Voi / Snížek leg." (1 individual, cScH), "E.Kenya / E Mwingi / W Nguni / 11.XII.2010 Snížek" (3 individuals, cWrB), "Kenya, Eastern / Mwingi, E of Nguni, 800 m / 26.11.2011 / lgt. Snížek" (2 individuals, cAsL, cLMM), same data as previous one, but "27.11.2011" (2 individuals, cAsL, cStW).

Diagnosis. A large *Lebistina* species, with a narrow dark humeral spot, a dark sutural band and a dark transverse band in the apical half of the yellow colored elytra (Fig. 1). Mentum with a tooth having two slightly discernable tips (Fig. 3).

Figure 1. *Lebistina rehagei* sp. n., habitus (female).

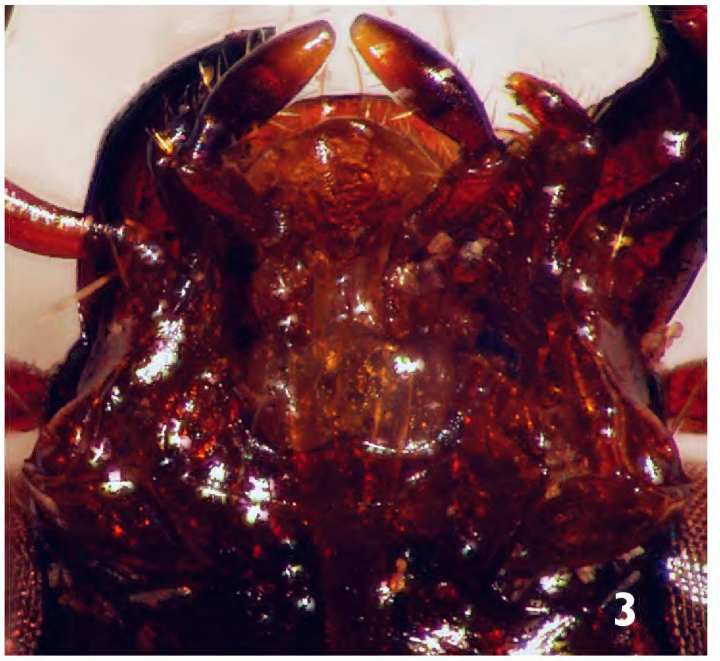
Description. Body length 9.5–13.7 mm; width 4.3–6.3 mm.

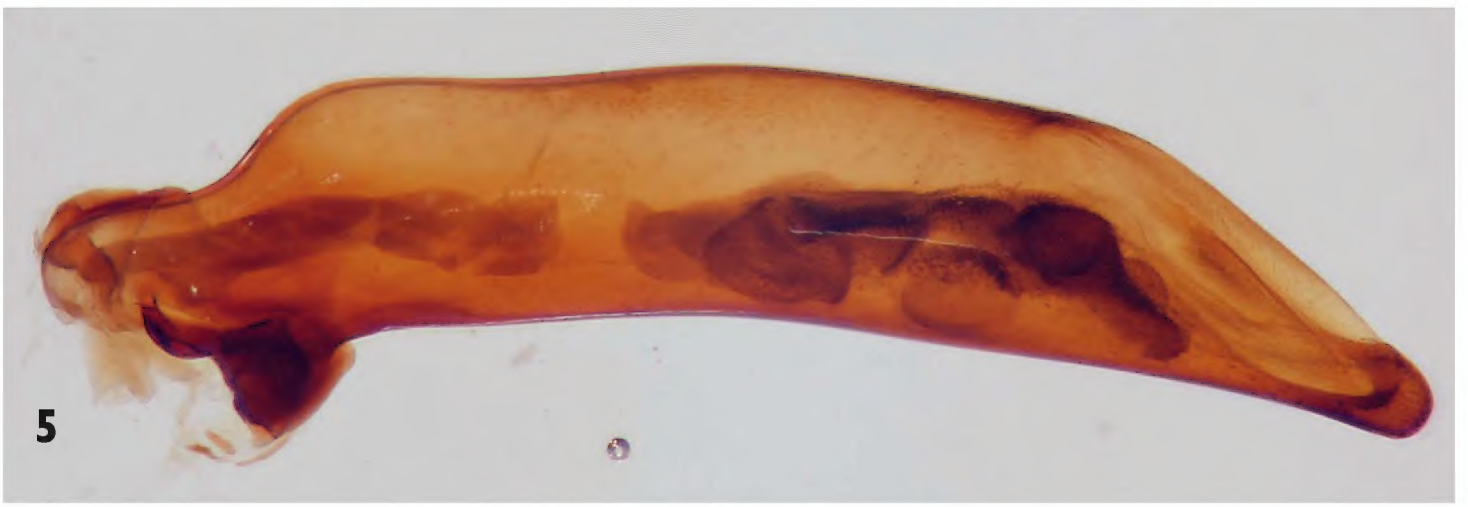
Color: Head red-brown, mandibles and palpi, especially distal segments dark brown to black. 1st or 1st to 3rd antennal segments red-brown, the following ones darker, tip of last segment brighter. Pronotum red-brown, the margins broadly translucent and yellow. Elytra yellow with characteristic dark red-brown and black pattern: Small and narrow, longitudinal humeral spot (as long as 3 elytral intervals wide); sutural band around the scutellum broad (approximately as wide as 3 to 4 elytral intervals on each side), on the disc restricted to the sutural interval, longitudinal strip becomes narrower and finally disappears close to the apex; in the apical half a broad transverse band (about one third of elytral length) from the sutural interval to the 9th interval; margin and epipleura yellow (Fig. 1). Legs red-brown to brown, without obvious darkening; claws yellow to brown. Last visible abdominal tergite yellow to brown, with in most specimens a dark spot on both sides. Lower side red-brown, without clear darkening, but margins of abdominal sternites sometimes darkened.

Head large, 0.80 to 0.86 times as wide as pronotum (ratio PW/HW: 1.18–1.30) (Fig. 2). Eyes protruding and hemispheric, more than one third of head width. Clearly punctated, around and between supraorbital setae wrinkled. Neck restricted. Antennae long, a little less than 2/3 of total body length; antennomeres 1 to 3 glabrous (excl. the long apical setae); antennomeres 4 to 11 with dense and fairly fine setae except obligatory long apical setae. Labrum about twice as wide as long. Ligula rounded at the tip, bearing some setae; paraglossae united with ligula, membranous, little shorter than ligula, bearing some setae. Mentum in the median part dentate, forming a tooth with two small tips (Fig. 3).

Pronotum wider than long (ratio PW/PL: 1.33–1.48), widest at approximately the middle (behind insertion of lateral setae) (Fig. 2). Anterior margin only slightly rounded and with a very fine and interrupted marginal line, anterior angles strongly rounded, from there continuously curved laterally until posterior angles, in front of basal setae straight; posterior angles well defined, almost rectangular, slightly obtuse (95–105°), rounded at the tip; median part of the base slightly protruding behind (less than 1/10 of PL). Pronotal lateral margin wide, clearly delimited from the disc; at the lateral seta (at the end of the first third of pronotal length) wider than length of antennomere 2, but narrower than length of antennomere 1; at the posterior angles as wide as 1/5 of pronotum length. Medial longitudinal impression deep, terminated at anterior and posterior transverse impression. Anterior transverse impression distinct, posterior transverse impression distinct and almost parallel to basal margin, strongly impressed at the inner border of the lateral margin, posterior angles upwards bent. Strongly punctated and punctures often fused to wrinkles.

Elytra 1.6 to 1.9 times broader than pronotum, (ratio EL/EW: 1.2–1.4), with protruding humeri, widest at the anterior margin of the broad dark transverse band or at its middle in the apical half. Apical margin of each elytron truncate, lateroposterior angle rounded, not projecting; in some individuals, inner third of apical margin sinuate and slightly serrated. Apically, suture rectangular or even prolongated to the apical





Figures 2–5. *Lebistina rehagei* sp. n. **2** head and pronotum (female) **3** head, lower side (male) **4** protarsus, lower side (male) **5** median lobe of aedeagus.

margin, forming a blunt tip. Striae slightly impressed and punctated; intervals flat, with two to five rows of irregular punctures, as some punctures fused to an irregular pattern. Four setiferous punctures in the third elytral interval.

Wings fully developed (macropterous).

Legs robust, tarsomeres 1 and 5 elongate, tarsomeres 2 and 3 triangular (females) to rounded (in males), tarsomere 4 at the apical margin deeply incised, all tarsomeres with numerous hairs underneath, tarsomeres 2 to 4 in males also with dense adhesive setae (Fig. 4). Claws pectinate, the number of teeth varies between (7-) 8 and 10 per claw.

Microsculpture consisting of isodiametric (to slightly transverse) meshes, less distinct on head and pronotum, hence integument appears fairly dull.

Median lobe of aedeagus elongate (in lateral aspect), slightly sinuose on dorsal surface, somewhat concave on ventral surface, not enlarged to the orificium (Fig. 5); internal sac of aedeagus without strongly sclerotized copulatory pieces, but a characteristic pattern of foldings in apical half of the median lobe. Left paramere oval, right one reduced to a small shaft.

Comparisons. The individuals of the new species differ from those of all other species of the genus by their characteristic coloration, shape of the median lobe of the ae-

deagus, mentum shape, body length, pronotum shape, broad pronotal margin, elytral punctuation intensity and the number of setiferous punctures in the 3rd elytral interval.

Etymology. It gives us great pleasure to dedicate this new species to our colleague and mentor Heinz-Otto Rehage (Münster, Germany), the former head of the Biological Station Heiliges Meer (North Rhine-Westphalia), well-known coleopterologist, who collected also in Africa and inspired us to study beetles and their natural history.

Distribution. Currently known only from Kenya.

Habitat. Unknown. The specimens were collected at light sources (Karl Werner and Miroslav Snížek, personal communication). *Lebistina rehagei* sp. n. lives sympatrically with *L. petersae* sp. n., *L. picta* (Dejean, 1825), *L. sanguinea* (Boheman, 1848) and/or *L. unicolor* (Putzeys, 1880), *L. neuvillei* Alluaud, 1918 and *L. peringueyi* Liebke, 1928.

Lebistina petersae Assmann, Drees & Zumstein, sp. n.

http://zoobank.org/50162F19-4FEA-42CB-B0AF-7CABE0332575

Figs 6–13

Type material. Holotype male: „Kenya, Tsavo East NP / 5 km sw of Lugards / Falls, 13.12.2000 / Ivo Martinů lgt." (ZSM). Paratypes (28 males and 26 females): "Kenya 2.XII.1996 / near Kipwezi / leg. Werner & Lizler" (2 individuals, cAsL), "Kenya, 28./30.XI.1997 / near Voi / leg. Werner & Lizler leg." (10 individual, cAsL), "Kenya-S. / Voi / 13.-17.xii.1997 / M. Snížek leg." (2 individuals, cFaP), "Africa – East – Kenya / Tsavo East , Voi Lodge / 3.23S/38.34 E, - 14.12.1999 / leg.: Dr. P. Croy" (1 individual, cAsL), "Tanzania 2.XII.1999 / near Namanga (at light) / leg. Werner & Lizler" (1 individual, cAsL), "Kenya, Tsavo East NP / SW of Lugards / Falls, 13.12.2000 / Ivo Martinů lgt." (1 individual, cAsL), same data but "Rudolf Kmeco leg." (1 individual, cFaP), "Kenya, Tsavo East N.P. / 5 km SW Lugard's Falls / 13.-14.XII.2000, M. Bednařík leg." (11 individuals, cScH, cBeO, cKmL), ("Kenya 1./3.V.2001 / NE Prov., El Walk / leg. Werner & Smrz" (1 individual, cAsL), "Kenya / Voi / IV-2006" (1 individual, cFaP), "C./S. Kenya / road between Naurobi-Mombasa / (Transafrican Highway) / Emali env. 1180 m / 28.X.2007 / T. Lebenbauer & A. Puchner" (2 individuals, cWrB), "Kenya, Eastern / E 729 Sosoma / 202 km E of Thika / 20.11.2007 / Snížek" (4 individuals, cAsL, cFaP), "Kenya SE / SW of Voi / 8.-12.2.2009 / lgt. Snížek" (8 individuals, cScH, cAsL), same data but "8.-12.12.2011" (1 individual, cAsL), same data but "8.-12.12.2012" (2 individual, cAsL), "E.Kenya / E Mwingi / W Nguni / 11.XII.2010 Snížek" (3 individuals, cWrB), "Kenya, Eastern / Mwingi, E of Nguni, 800 m / 26.11.2011 / lgt. Snížek" (4 individuals, cAsL).

Diagnosis. A small *Lebistina* species, with a complex black pattern on yellow elytra: a slender dark humeral spot longitudinally prolonged on intervals 6–8 (rarely this spot can be connected with the dark medial transverse band: Fig. 13), a sutural band stretched on intervals 1–4 and two dark transverse bands (as the posterior one can be interrupted in a few individuals) in the apical half on each elytron (Figs 6, 12–13). Mentum with two rounded teeth (Fig. 8).

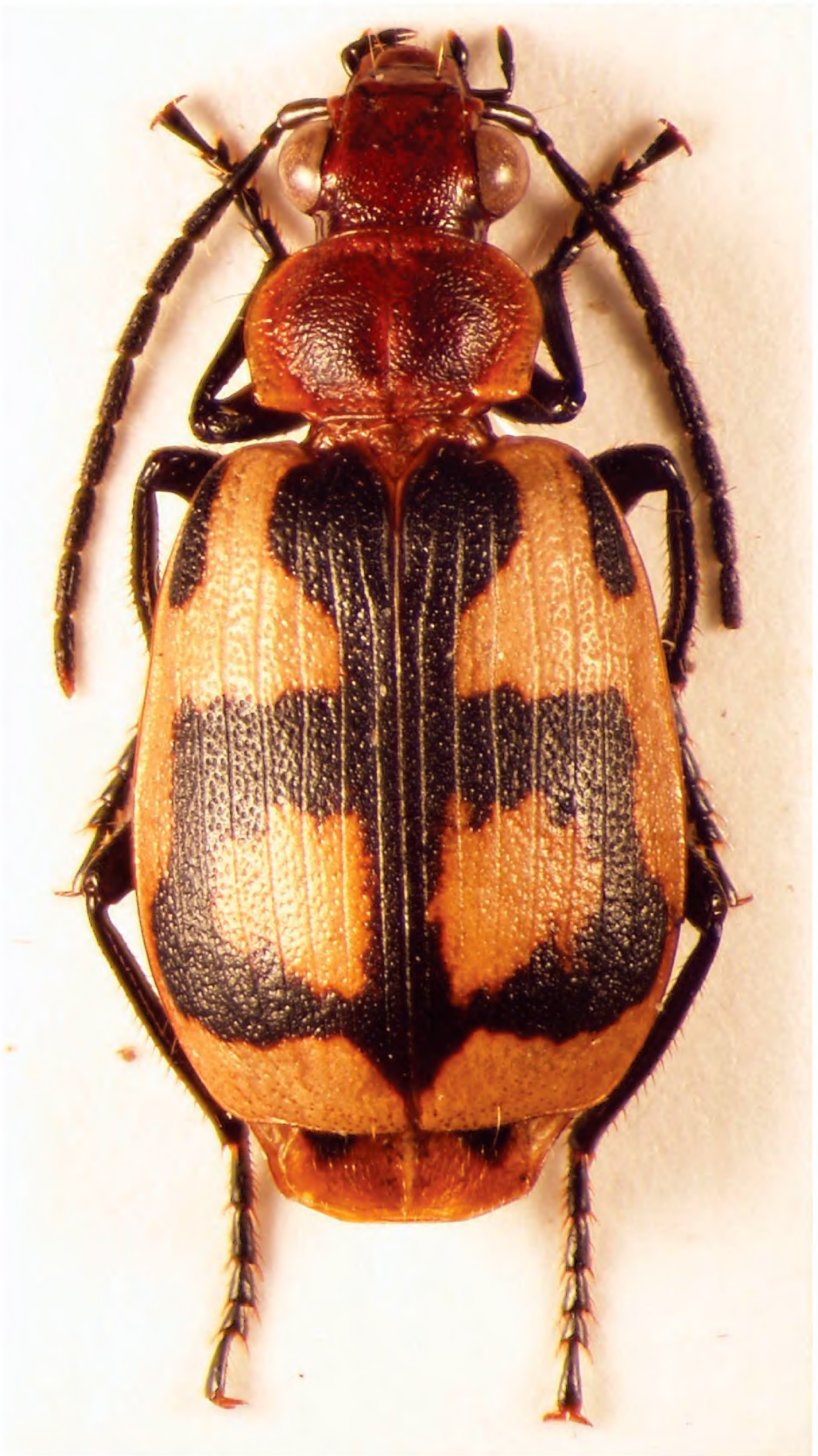


Figure 6. *Lebistina petersae* sp. n., habitus (female).

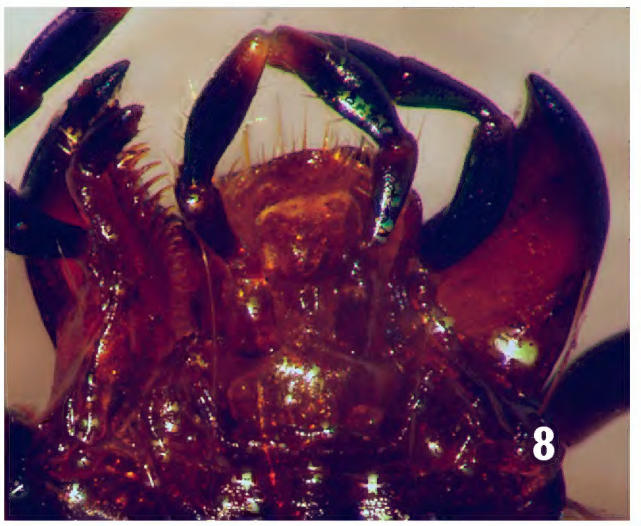
Description. Body length 7.9–10.5 mm; width 4.0–4.9 mm.

Color: Head red-brown, mandibles and palpi, especially distal parts or segments dark brown to black. Antennae black, sometimes the antennomere 1 and part of the consecutive one red-brown, tip of last segment brighter. Palpi black, last segments on the tip brightened. Pronotum red-brown, the margins broadly translucent and yellow. Elytra yellow with characteristic dark brown to black pattern (Fig. 6): Longitudinal dark humeral spot (as long as 4 elytral intervals wide) at the 6th and 7th striae; sutural band around the scutellum broad (as wide as 3 to 4 elytral intervals on each side), at the beginning of the second third of the elytral length restricted to the two inner intervals; two transverse bands, one anterior at the elytral middle, as thick as 2 to 3 inner elytral intervals wide together, and a posterior one in the apical fourth, slightly narrower than the anterior transverse band; in a few individuals, the humeral spot extends posteriorly (on 7th and 8th intervals) and fuses with the anterior transverse band; angles of all bands rounded or protruding, rarely reduced (Fig. 12); the entire elytral margin broadly yellow, with exception of the humeral longitudinal spot. Epipleura yellow. Legs dark brown to black, but basal two thirds of tibia red-brown, distal part of onychium brighter, claws yellow to brownish. Last visible abdominal tergite yellow to brown, with a large dark spot on both sides. Lower side red-brown, without clear darkening.

Head large, 0.80–0.86 times as wide as pronotum (ratio PW/HW: 1.18–1.30) (Fig. 7). Eyes protruding and hemispheric, more than one third of head width. Strongly punctated, around and between supraorbital setae wrinkled. Neck slightly restricted. Antennae long, slightly less than two third of total body length; antennomeres 1 to 3 glabrous (excl. the long apical setae); antennomeres 4 to 11 with dense and fairly fine setae except obligatory long apical setae. Labrum about 1.5 as wide as long. Ligula rounded at the tip, bears some setae; paraglossae united with ligula, membranous, little shorter than ligula (Fig. 9). Mentum sinuated, bidentate (Fig. 8).

Pronotum wider than long (ratio PW/PL: 1.41–1.59) (Fig. 7), widest at about the middle or behind. Anterior margin only slightly rounded and with a fine marginal line, anterior angles strongly rounded, sides in basal half constricted towards posterior margin, straight or slightly concave to the well-defined, almost rectangular, slightly obtuse, rounded at extreme tip (90–100°) posterior angles; median part of the base slightly protruding behind (less than 1/10 of PL). Pronotal lateral margin wide, only weakly delimited from the disc; at the lateral seta (at the end of first third of pronotal length) wider than length of antennomere 2, but narrower than length of antennomere 1; at the posterior angles as wide as about 1/4 of pronotum length. Medial longitudinal impression moderately deep, terminated at anterior and posterior transverse impression. Anterior transverse impression less distinct; posterior transverse impression less distinct and straight, impressed at the inner border of the lateral margin, posterior angles upwards bent; basal margin slightly convex. Strongly punctated and punctures often fused to wrinkles.

Elytra 1.7 to 1.9 times broader than pronotum (ratio EL/EW: 1.1–1.3), with protruding humeri, widest behind the middle, about the end of second third. Apical margin truncate, somewhat sinuate, slightly serrated; the lateroposterior angles rounded,



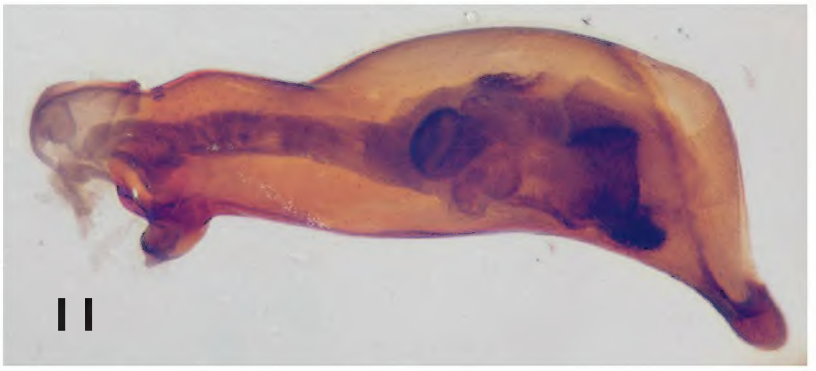


Figure 7–13. *Lebistina petersae* sp. n. **7** head and pronotum (female) **8** head, lower side (female) **9** ligula and paraglossae (female) **10** protarsus, lower side (male) **11** median lobe of aedeagus **12** elytra with reduced dark pattern (female) **13** elytra with large dark pattern (female).

not projecting. Apical suture ends in a broad rounding to the apical margin. Striae slightly impressed and punctated; intervals flat, with two to three rows of irregular punctures, which are partly fused to an irregular pattern. Two setiferous punctures in the third elytral interval.

Wings fully developed (macropterous).

Legs robust, tarsomeres 1 and 5 elongate, tarsomeres 2 and 3 triangular (females) to rounded (in males), tarsomere 4 at the apical margin deeply incised, all tarsomeres with numerous hairs underneath, tarsomeres 2 to 4 in the males also with dense adhesive setae (Fig. 10). Claws pectinate, the number of teeth varies between 7 and 9 per claw.

Microsculpture consisting of isodiametric (to slightly transverse) meshes, surface slightly shiny.

Median lobe of aedeagus relatively short; the basal part almost parallel, to the orificium curved and broadened, tip rounded and downward bent; internal sac with several bulbi having knobs and a stronger sclerotized area close to the orificium, without strongly sclerotized copulatory pieces (Fig. 11). Left paramere oval, right one reduced to a small shaft.

Comparisons. The individuals of the new species can be differentiated from those of all other species of the genus by their characteristic coloration and the form of the median lobe of the aedeagus. They also exhibit a specific combination of body length (7.9–10.5 mm), broad pronotum, bidentate mentum, and two setiferous punctures in third elytral interval.

Etymology. It gives us great pleasure to dedicate this new species to Marianne Peters, our former co-worker in the Institute of Ecology at the Leuphana University Lüneburg. She supported us in many respects, especially with the mounting and preparation of African ground beetles, and provided great assistance work on these beetles.

Distribution. Currently known only from Kenya and Tanzania.

Habitat. Unknown. Most of the specimens were collected at light sources (Karl Werner and Miroslav Snížek, personal communication). *Lebistina petersae* sp. n. lives sympatrically with *L. rehagei* sp. n., *L. picta* (Dejean, 1825), *L. sanguinea* (Boheman, 1848) and/or *L. unicolor* (Putzeys, 1880), *L. neuvillei* Alluaud, 1918 and *L. peringueyi* Liebke, 1928.

Discussion

Both new species belong to the genus *Lebistina*, established by Motschulsky in 1864, and best characterized by Chaudoir (1877). The form of the ligula and the adjacent paraglossae, both with numerous setae, the form of the tarsi (including the order of the adhesive setae in males), the strongly rounded anterior angles of the pronotum, the weakly impressed elytral striae, and other morphological features are all in congruence with the characters given for the genus *Lebistina* (Chaudoir 1877, Péringuey 1896). However, the occurrence of one mentum tooth (*L. rehagei* sp. n.) or two teeth (*L. petersae* sp. n.) seems to be deviating character states for the genus (cf. Péringuey 1896). The presence of a mental tooth is characteristic for the genus *Matabele* Péringuey, 1896, which also shares the unique ligula and paraglossae characters with *Lebistina*. However, our two new species do not belong to *Matabele*. The slight depression of the elytral striae, the flat elytral intervals, the punctuation of the body, and especially the rounded, only slightly sinuate elytral apex with a lack of sharp and projecting posteriolateral angles contradict an assignment to the genus *Matabele*. Therefore, the position of both new species within the genus *Lebistina,* which now contains a total of 14 species (cf. Lorenz 2005), is justified.

The members of the genus *Lebistina* have species-specific elytral coloration with dark patterns on a yellow-brownish background allowing for easy identification of most of the species (e.g. Anichtchenko 2016). To guarantee a correct identification,

we suggest the additional examination of morphological characters such as the glossal sclerite (ligula, paraglossae), order of adhesive setae on the protarsi in males, etc. Some other lebiine genera seem similar at first view, but do not show these unique characters or their combinations (e.g. Fig. 5 in Chaboo et al. 2016 does not look like a *Lebistina* species but may be a member of *Lebiomorphica* Lorenz, 1998). We hope that the description of these two conspicuous *Lebistina* species will stimulate further studies on this fascinating carabid genus as numerous facets of the biology, ecology, natural history and toxicology of the *Lebistina* species are still unclear.

Acknowledgements

We would like to thank all of the coleopterologists who provided carabid catches from Africa, especially Karl Werner (Munich, Germany; †), Miroslav Snížek (České Budějovice, Czech Republic) and David Wrase (Berlin, Germany). Moreover we cordially thank Sergio Faccini (Piacenza) for the fruitful discussions about African ground beetles and his numerous identifications of them. We are indebted to the curators Dr. Martin Baehr (ZSM), Dr. Michael Bahlke (ZSM), Dr. Thierry Deuve (Paris, France), and Dr. Mark de Meyer (Tervuren, Belgium) for the loan of material or for otherwise allowing us access to specimens in their care, without which this study would not have been possible.

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